Remarks

Claims 1-2, 5-7, and 10 are pending in the application. Claims 1, 5, 6, and 10 have been amended. Claims 3-4 and 8-9 have been canceled.

In the Office Action, claims 1-4 and 6-9 were rejected under 35 U.S.C. §103 being unpatentable over Applicants' own admission recited in independent claim 1 of the prior art. Applicants respectfully traverse this rejection based on the claims as currently amended.

Claim 1, as currently amended provides a process for producing 1,3-propanediol in which an aqueous solution of 3-hydroxypropanal is formed which is neutralized to a pH of at least 5 with potassium hydroxide, ammonium hydroxide, lithium hydroxide, or calcium hydroxide in place of sodium hydroxide, and the neutralized solution is hydrogenated and distilled to produce 1,3-propanediol, water, and reactive heavy components. Substitution of potassium hydroxide, ammonium hydroxide, lithium hydroxide, or calcium hydroxide for sodium hydroxide reduces the viscosity of the reactive heavy components produced in the process. Claim 6, as amended, provides a reactive heavy components stream produced by a process such as that claimed in claim 1.

The Patent Office contends that it would have been obvious to have used hydroxides other than sodium hydroxide in the process claimed in claim 1 with a reasonable expectation of success to produce 1,3-propanediol from 3-hydroxypropanal. The Patent Office concedes, however, that reduction of viscosity of the reactive heavy components is not obvious, and admits that use of potassium hydroxide and ammonium hydroxide would not be obvious in the claimed process (*see, e.g.,* paragraphs 13 (allowable subject matter) and 11 of the Office Action of February 6, 2007). Particularly, the Patent Office notes that the showing on pages 9-10 of the specification is sufficient to establish that potassium and ammonium hydroxide would not be obvious as claimed in claims 1 and 6; that the showing is deficient with respect to the other hydroxides; and invites Applicants to show that the other claimed hydroxides would likewise produce a trend in the reduction of viscosity (*see* paragraphs 11 and 12 of the Office Action of February 6, 2007).

Claims 1 and 6 have been amended to limit the hydroxides used in the process to potassium, ammonium, lithium, and calcium hydroxide. As noted above, the Patent

Office admits the showing of reduction of viscosity for potassium hydroxide and ammonium hydroxide relative to sodium hydroxide is sufficient to establish the non-obviousness of process claimed in claim 1 using potassium or ammonium hydroxide and the product produced thereby, as claimed in claim 6. Applicants contend that a sufficient showing has been made in the specification with respect to lithium and calcium hydroxide to establish the non-obviousness of the process claimed in claim 1 and the product claimed in claim 6 utilizing lithium or calcium hydroxide in place of sodium hydroxide.

With respect to lithium hydroxide, Example 4 discloses neutralizing 60 g of 1,3-propanediol (0.78 moles) with 3.2 g of LiOH (0.13 moles) in 40 g of water (2.2 moles). LiOH is present in the mixture at a ratio of 0.13 moles LiOH to 2.98 moles H_2O+PDO, or a molar ratio of 0.043:1. The reactive heavy components produced when using LiOH to neutralize the PDO had a viscosity of 914 mm^2/s at 40°C. Example 2 discloses neutralizing 60 g of 1,3 propanediol (0.78 moles) with 1.62 g of NaOH (0.04 moles) in 4.5 g of water (0.25 moles). NaOH is present in the mixture at a molar ratio of 0.04 moles NaOH to 1.03 moles H_2O+PDO, or a molar ratio of 0.039:1. The reactive heavy components produced when using NaOH to neutralize the PDO had a viscosity of 5686 mm^2/s at 40°C. Therefore, the Examples show that when LiOH is used to neutralize PDO in a molar ratio of neutralizing agent to solution that is approximately equivalent to NaOH (0.043 v. 0.039) that the viscosity of the resultant reactive heavy bottoms after distillation is much lower when using LiOH than when using NaOH.

With respect to calcium hydroxide, Example 4 discloses neutralizing 60 g of PDO (0.78 moles) with 1.7 g $Ca(OH)_2$ (0.023 moles) in 20 g of water (1.1 moles). $Ca(OH)_2$ is present in the mixture at a ratio of 0.023 moles $Ca(OH)_2$ to 1.88 moles of H_2O+PDO, or a molar ratio of 0.012:1. The reactive heavy components produced when using $Ca(OH)_2$ to neutralize the PDO had a viscosity of 88 mm^2/s at 40°C. Example 1 discloses neutralizing 10 g of PDO (0.13 moles) with 0.27 g of NaOH (0.0067 moles) in 2.5 g of water (0.13 moles). NaOH is present in the mixture at a ratio of 0.0067 moles of NaOH to 0.26 moles of H_2O+PDO, or a molar ratio of 0.026. The reactive heavy components produced when using NaOH to neutralize the PDO was judged to be very viscous at 40°C. Calcium hydroxide contains two equivalents of hydroxide ions and sodium

hydroxide contains one equivalent of hydroxide ions, therefore, the amount of calcium hydroxide used in Example 4 has approximately the same neutralizing capacity as the amount of sodium hydroxide used in Example 1 (equivalent ratio of OH^- to solution for $Ca(OH)_2$ = 2x molar ratio of $Ca(OH)_2$ to solution = 0.024; equivalent ratio of OH^- to solution for NaOH = 1x molar ratio of NaOH to solution = 0.026) . Therefore, the Examples show that when $Ca(OH)_2$ is used in a neutralizing amount approximately equivalent to NaOH to neutralize PDO that the viscosity of the resultant reactive heavy bottoms after distillation is much lower when using $Ca(OH)_2$ than when using NaOH.

Claims 2 and 5 depend from claim 1, and, therefore, are not obvious since claim 1 is not obvious as discussed above. Claims 7 and 10 depend from claim 6, and, therefore, are not obvious since claim 6 is not obvious as discussed above. Claims 3, 4, 8, and 9 have been cancelled.

In light of the above, Applicants respectfully request allowance of the remaining pending claims 1-2, 5-7, and 10.

Respectfully submitted,
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